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Farmer Mentoring in Determining Fertilization Dosage of Corn Plants (*Zea Mays* L.) Using Soil Test Equipment

*Pendampingan Petani Dalam Penentuan Dosis Pemupukan Tanaman Jagung (*Zea Mays* L.) Dengan Menggunakan Perangkat Uji Tanah*

Johanes Amirullah^{1*)}, Yanter Hutapea¹, NPS Ratmini¹, dan Agung Prabowo²

¹Balai Pengkajian Teknologi Pertanian Sumatera Selatan, South Sumatra 30151

²Balai Pengkajian Teknologi Pertanian Jawa Tengah, Semarang 50552

^{*)}Corresponding author: joe.amirullah@gmail.com

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ABSTRAK

Komoditas tanaman jagung memiliki peranan penting di bidang pangan dan pakan, peningkatan produksi jagung dapat dilakukan melalui program intensifikasi seperti pemupukan. Pemupukan berimbang sangat penting dilakukan di tanah marginal. Kendala dalam pemanfaatan tanah marginal, yaitu: sifat fisik, kimia dan biologi tanah kurang mendukung pertumbuhan tanaman. Tanah marginal biasanya memiliki nilai pH masam dan kandungan unsur hara terutama P rendah karena terfiksasi sehingga P merupakan kendala pertumbuhan tanaman. Tanah pada pH tinggi memiliki permasalahan rendahnya kandungan P tersedia tanah karena adanya fiksasi oleh kalsium tanah. Penentuan dosis pemupukan untuk komoditi tanaman jagung dalam satu wilayah bisa berbeda tergantung dari kandungan unsur hara yang tersedia, sehingga perlu dilakukan pengujian. Kajian ini bertujuan melakukan pendampingan petani dalam pengambilan sampel tanah yang tepat dan menentukan dosis pupuk sesuai dengan spesifik lokasi serta cara aplikasi pemupukan tepat sasaran dengan menggunakan Perangkat Uji Tanah Kering (PUTK). Kegiatan ini dilakukan di Desa Fajar Jaya, Kabupaten Ogan Komering Ulu di bulan Februari 2019. Hasil analisis tanah di lokasi yang akan dijadikan demplot, yaitu: kesuburan tanah rendah dengan tingkat keasaman tanah pada pH 4-5 dengan kriteria masam, unsur hara P sedang, K dan C-Organik tergolong rendah. Cara aplikasi pemupukan yang diterapkan oleh petani belum sesuai anjuran. Rekomendasi pemupukan yang dianjurkan, sebagai berikut: urea 325 kg/ha, diberikan 3 kali, sepertiga dosis, dilakukan 1 MST, 4 MST dan 6 MST; TSP 200 kg/ha; KCl 125 kg/ha; kompos 5.000 kg/ha. Pemberian kapur 1.000 kg/ha ditebar pada saat pengolahan tanah 1 minggu sebelum tanam.

Kata kunci: dosis pupuk, tanaman jagung, perangkat uji tanah

ABSTRACT

Balanced fertilization is very important to do in marginal soils. The constraints in the use of marginal soils are physical, chemical and biological soil characteristics which do not support planting growth. Determination of fertilizer dosage for corn commodity in one region can be different depending on the available nutrient content that testing needs to be

carried out. This study aimed to mentor farmers in taking appropriate soil samples and determined fertilizer doses according to location specifications and application of fertilizers on target using the Dry Soil Test Kit (*Perangkat Uji Tanah Kering*). This activity was carried out in Fajar Jaya Village, Ogan Komering Ulu District in February 2019. The results of the soil analysis of the location used as a demonstration plot derived from the results of low soil fertility analysis with soil acidity at pH 4-5 with acid crystals, moderate P, K and C-organic nutrients were relatively low. The recommended fertilizer is as follows: urea 325 kg/ha given 3 times, one-third the dose, carried out 1 MST, 4 MST and 6 MST; TSP 200 kg/ha; KCl 125 kg/ha; 5,000 kg/ha of compost and 1,000 kg/ha of lime stocked during tillage 1 week before planting. Fertilization application method applied by farmers is not in accordance with the recommendations; consequently, it is necessary to fertilize to increase nutrient content.

Keywords: fertilizer doses, corn plants, soil test kits

INTRODUCTION

Corn is the second staple food after rice used as a source of carbohydrates, industrial raw materials, and animal feed. Increasing the population and industrial development will directly have an impact on increasing demand or consumption of corn. Efforts in increasing corn production through intensification and extensification are always accompanied by the use of balanced fertilizers both organic and inorganic fertilizers. The use of balanced fertilizers is based on the needs of plants by considering the ability of the soil to provide nutrients naturally, the sustainability of the production system, and adequate profits for farmers (Sirappa dan Razak, 2010).

Balanced fertilization is very important to do in marginal soil; one of the types of marginal soil is ultisols. The constraints in their utilization are the physical, chemical and biological properties of the soil which do not support plant growth. Ultisol soil usually has an acidic pH value and nutrient content, especially low P because it is fixed so that P is an obstacle to plant growth. Soil at high pH has a problem of low P content of available soil due to the fixation by soil calcium (Tan, 2008). Increased productivity of corn plants can be cultivated through the application of technology in cultivation including by conducting a balanced fertilization that meets the nutrients needed by plants. This is conducted since the corn plant will not provide maximum results if

the nutrients needed for growth are not enough available especially macro elements for plants (Suntoro, 2014). Determination of fertilizer doses for certain commodities from one region to another may differ depending on the available nutrient content; therefore, testing is needed to determine the content of the nutrients. The test results may be location specification, meaning that it may not occur or differ from other regions.

Farmers need to be involved from the beginning in the assessment so that they will understand more and give rise to an agreement to implement. Mentoring is part of the development and dissemination of technological innovations through reciprocal communication processes, where the actors provide as well as receive information and technology as well as mutual understanding and agreement. If the community is expected to adopt an innovation, then the community must be sure that the innovation meets a need that is truly felt (Bunch, 2001). Innovation will become the needs of farmers if the innovation can solve the problems faced by the farmers. In other words, the correct identification of problems is very important. In order for the farmers to be able to apply the new technology, there are various steps or efforts and different approaches needed to convince the farmers. Active participation of the farmers and other users, even that of field officers, will further accelerate the adoption of these

technological innovations. *BPTP* as the spearhead of the Agency for Agricultural Research and Development in the regions plays a strategic role in generating and disseminating agricultural innovations of location specification to various stakeholders (*Badan Litbang Pertanian*, 2010). It is expected that with the development of location-specific agricultural technology for farmers, benefits will be obtained in the form of increased productivity and stability and equitability of production.

The selection of superior commodities in accordance with the resources available in a solid agribusiness system, comparative and competitive advantages can be achieved in a particular agro-ecosystem so that agricultural businesses can be developed to benefit farmers in a sustainable manner. The study aimed to mentor farmers in taking appropriate soil samples and determine the dose of fertilizer in accordance with location specification, as well as applying the fertilizers on target through farmer assistance activities.

MATERIALS AND METHODS

This study was carried out in Fajar Jaya Village, Lengkiti Subdistrict, Ogan Komering Ulu District in February 2019. The sampling was taken by the farmers mentored by the researchers of the *Balai Pengkajian Teknologi Pertanian Sumsel* (*BPTP*-South Sumatra Agricultural Technology Assessment Center). Before the sample was collected, the farmers were directed and given an explanation of the method of taking the sample and the location or position of the drilling. The sampling was carried out by purposive random sampling method at a depth of 0-20 cm.

The soil samples were taken as many as 10 samples, and then they were compiled and analyzed using Dry Soil Test Equipment (*PUTK*). Composite soil samples are those taken from several samples to be used as representatives of

certain soil characteristics (Suryono *et al.*, 2015).

PUTK is a tool for the analysis of nutrient levels of dry land which can be used in the field quickly, easily, cheaply and fairly accurately. It is designed to measure the levels of P, K, C-organic, pH and lime requirements (Anonymus, 2007). Soil analysis was carried out at the *BPTP* Soil Laboratory of South Sumatra, and then the data were discussed in a descriptive manner. The nutrients to be analyzed, among other things are as follows: soil pH, soil P, soil K, C-Organic, and lime.

RESULTS AND DISCUSSION

Mentoring for Farmers in Sampling

Mentoring is one of the important aspects needed to support the success of the program of the Ministry of Agriculture. The holistic, synergistic, coordinated, focused, and measurable mentoring is highly expected by all parties to accelerate the achievement of the targets set. Through escorting or mentoring of a development program of food crop area, the farmers are expected to be able to implement technological innovations from the Agency for Agricultural Research and Development (Hendayana, 2011). Mentoring in soil sampling started from providing the farmers an explanation of how the sampling could be done through determining the sample points diagonally, zigzagging, systematically, and randomly (Triyanto, 2018).

Although the land taken on dry land, the land taken should be sought in a humid state (not too wet and dry). Soil samples could be taken with a drill, hoe, or shovel at a depth of 0-20 cm, and then stirred evenly those already collected from some of these points. Farmers had to know that soil sampling should not be taken from ex-fertilization or fertilizer pile, livestock grazing, former location or location of incineration, or roadside. After being directed on the procedure of soil sampling, the farmers practiced the soil sampling

using the four methods conducted directly in the field. Mentoring is a meaningful activity of coaching and teaching. The word mentoring is more meaningful in togetherness, alignment, sideways side-by-side, and therefore the position between the two (the mentor and the mentored person) is equal, so there is no dichotomy between superiors and subordinates (Hendayana, 2011).

This has implications for the role of the mentor which is limited to providing alternatives, suggestion, and consultative assistance and not on decision making. According to Tjiptopranoto (2000), the application of the technology to be developed must be adapted to the potential of local resources at a low cost and easy to implement but can provide increased yields quickly. This is an important aspect for the sustainable application of the recommended technology and farming systems. Therefore, the farmers are expected to be able to adopt and implement the technology referred to in their farming to improve their income. Through mentoring, the farmers were able to take soil samples. For the purpose of analyzing soil nutrient content, the diagonal sampling was carried out in this activity.

Analysis of Soil on Dry Land for Corn Crops

Before the land was managed and planted with corn plants, a soil test was first carried out to determine the soil nutrient content at the beginning before the corn crop. The results of preliminary analysis of the soil showed that the soil pH content was 4-5 with acid criteria. According to Hardjowigeno (2015), soils with acidic pH micro elements dissolve easily and

contained a lot of micro elements, while micro elements themselves are elements that plants need in small amounts. Yet, they become poisonous if they are found in large quantities.

Implementasi penggunaan pupuk dan kapur pada aktivitas penanaman jagung (Tabel 1). Implementation of the use of compost, fertilizer (P, K) and lime in the monitoring of corn planting in Fajar Jaya Village, Lengkiti Subdistrict, OKU District, in addition to using the results of soil nutrient analysis based on the use of PUTK, took into account the other factors, such as the results of previous studies and the number of planted corn population. Implementation of fertilizer and lime use in corn planting activities is shown (Table 1).

The results of the initial soil analysis showed that the soil reacted from an acid manner to moderate C-organic. This condition is still suitable for corn plants; however, to produce optimally throughout the growing season requires more intensive management in order to maintain land sustainability. Although the levels of soil organic matter and P were moderate, to maintain soil fertility requires a proper management. Soil fertility management is not only by applying fertilizer, but also by improving soil physical properties, so that there is a good environment for plant growth; soil microbial life for important processes in the soil (Abduracman *et al.*, 2008). This can be achieved through balanced fertilization and the provision of organic material in the form of manure or compost at each planting season as well as by improving land preparation systems or tillage.

Table 1. Application of mentoring of the fertilization of corn plants

Fertilizer	Dose	Time
Urea	325 kg/ha	Given 3 times, @ one-third the dose carried out 1 MST, 4 MST and 6 MST
TSP	200 kg/ha	Simultaneously urea fertilizing I MST,
KCl	125 kg/ha	Simultaneously urea fertilizing I MST,
Compost	5,000 kg/ha	Mature compost given as a cover for the planting hole.
Lime	1,000 kg/ha	Lime sprinkled on 1 week before planting

According to Tarigan *et al.* (2015), benefit of organic matter can improve soil structure, increase soil temperature, aggregate stability, can store water, reduce soil sensitivity to erosion, and become a source of energy for soil microorganisms. Intensive soil management needs to be done to increase the pH of the soil in acid soils by using lime and organic matter. The benefits of giving lime before planting aimed to increase soil pH and reduce micro nutrients that are toxic to plants. Soil organic matter, in addition to helping increase soil pH also plays a role in improving soil fertility. Based on the results of soil analysis, the need of lime was 1,000 kg/ha and C-organic was 5,000kg/ha. Nurmasyitah *et al.* (2013) state that organic matter can increase biological activity and metabolism, produce and release organic compounds that play a role in binding metal cations that cause soil acidity thereby increasing pH. According to Jumini (2011), fertilization is expected to improve soil fertility, including replacing nutrients lost due to leaching or erosion and which are caused by the harvest. In Table 1, the doses applied for urea fertilizer, one-third at 1 MST, 4 MST and 6 MST at a dose of 325 kg/ha, while TSP fertilizer at a dose of 200 kg/ha and KCl 125 kg/ha, respectively applied simultaneously with urea fertilizer at 1 MST. Based on the results of analysis and observations in the field the need for compost was 5,000 kg/ha.

The purpose of giving compost, in addition to adding soil organic matter to increase nutrient availability, was to reduce soil acidity so that the need for dolomite lime could be reduced. According to Soepardi (2001), organic matter in addition to functioning as a soil enhancer can also increase soil fertility because it can contribute a number of macro and micro nutrients needed by plants. Based on the analysis and observations in the field, the need for lime was only 1,000 kg/ha. Provision of lime can neutralize the soil pH content in order to be able to break down the nutrients bound by metal elements

harmful to plants. One of these elements is Fe which is toxic to plants if the soil contains a lot of nutrients. According to Indrasari and Syukur (2006), the addition of lime can reduce micro nutrient solubility due to an increase in pH. Acid soil adversely affects plant growth causing the low obtained results. To overcome this, it is necessary to apply lime into the soil (Subandi and Wijanarko, 2013). Good land conditions, if the nutrients are naturally fulfilled, but if the conditions are not good, modifications can be made, namely with or without tillage. The addition of organic material in the form of compost or manure is one component of the technology package in corn cultivation. In the technology component applied to the integrated corn crop management (*PTT*), organic material in the form of manure is given at a rate of 1.5-2.0 tons/ha and the method of administration is placed in a planting hole as a cover for seeds (*Badan Litbang Pertanian*, 2008).

Organic matter in addition to functioning as a soil enhancer can also increase soil fertility because it can contribute a number of macro and micro nutrients which are very needed by the plants. The provision of high quantities of organic material can reduce the use of chemical fertilizers. An agricultural land intensively cultivated throughout the year will experience degradation, which is characterized by a low c-organic soil content of <2%. This situation will be more critical if every harvest season the crop waste is transported off the field (Abdurachman *et al.*, 2008). Harvesting is one of the activities of the final stage in the cultivation of corn which is expected to produce high yields so that farmers can benefit and be able to return farm capital. The results of the monitoring of farmers, using the recommended doses, the dry shelled corn production for zigzag system was 4.55 tons/ha, while the tile system was 4.29 tons/ha. So far, the behavior of farmers in cultivating corn plants with a tiled system and using fertilizer has not been in accordance with

the recommended doses that production is low, which in turn will have an impact on the income.

The low production of corn is influenced by the low level of soil fertility, low-yielding varieties grown, and cultivation and maintenance techniques are not optimal (Najmah and Razak, 2003). From the monitoring result, it is expected that farmers are able to manage and process their farming by improving the system to be better so that their income and welfare increases.

CONCLUSION

Farmers have been able to carry out soil sampling through four ways, namely zigzag system, systematic, random system, and diagonal system. The results of soil nutrient analysis using *PUTK* showed that the P nutrient content was classified as moderate, K and C-Organic were classified as low and soil pH was included in the acid criteria. Fertilization needs to be done to increase nutrient content and addition of lime to increase soil pH at the site of mentoring. Recommended fertilizer dose is as follows: Urea 325 kg/ha, SP 36 200 kg/ha, KCl 125 kg/ha, compost 5000 kg/lime present 1000 kg/ha.

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